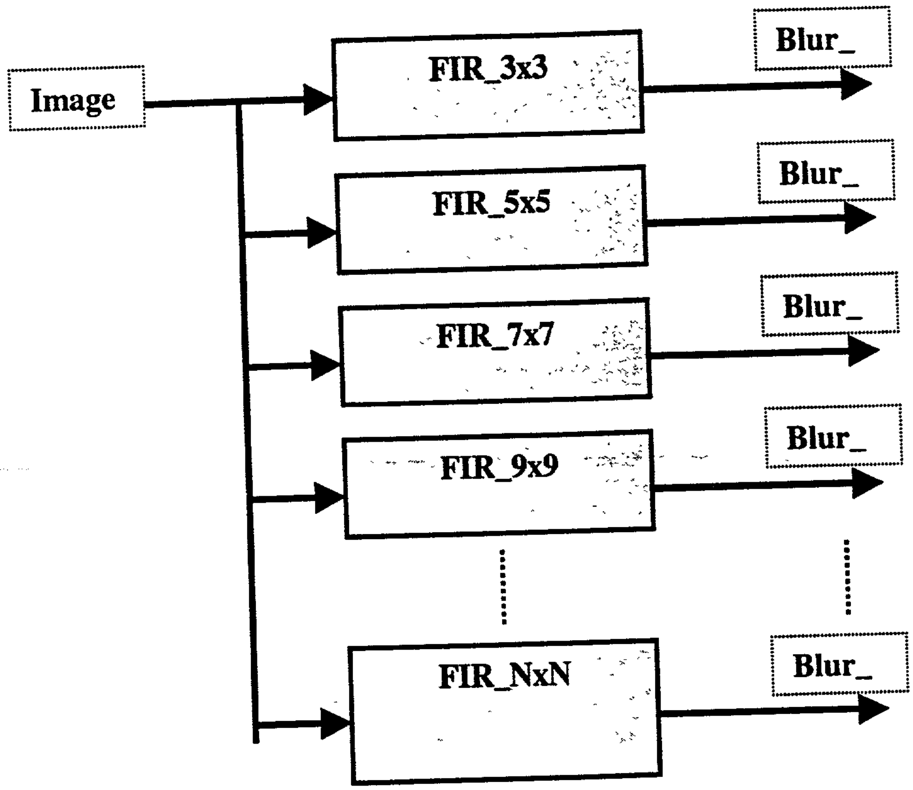
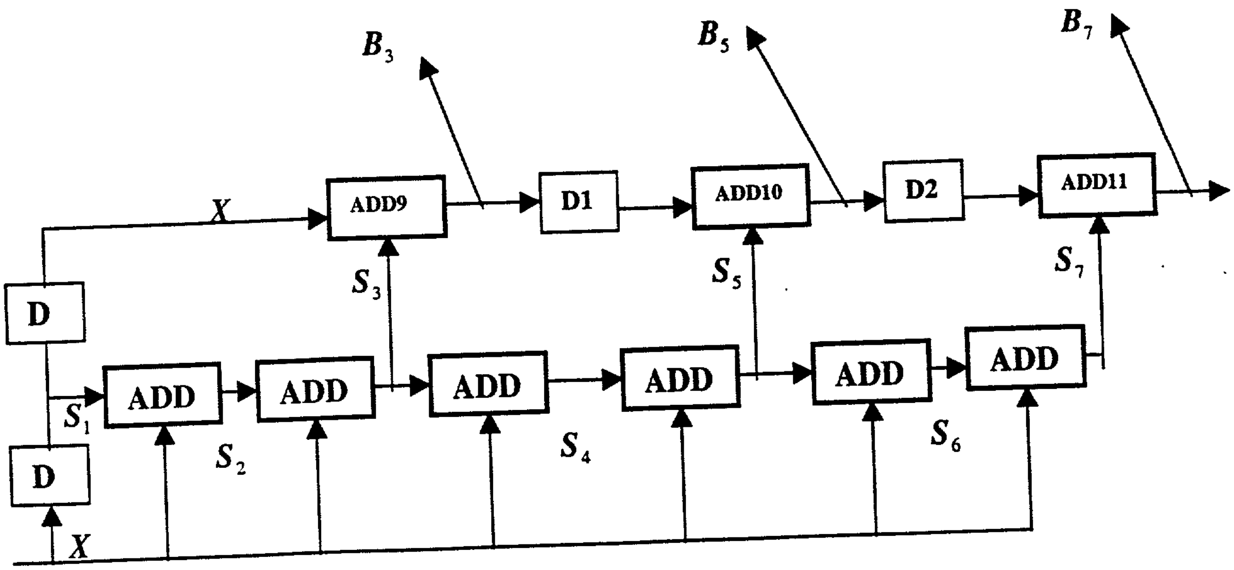


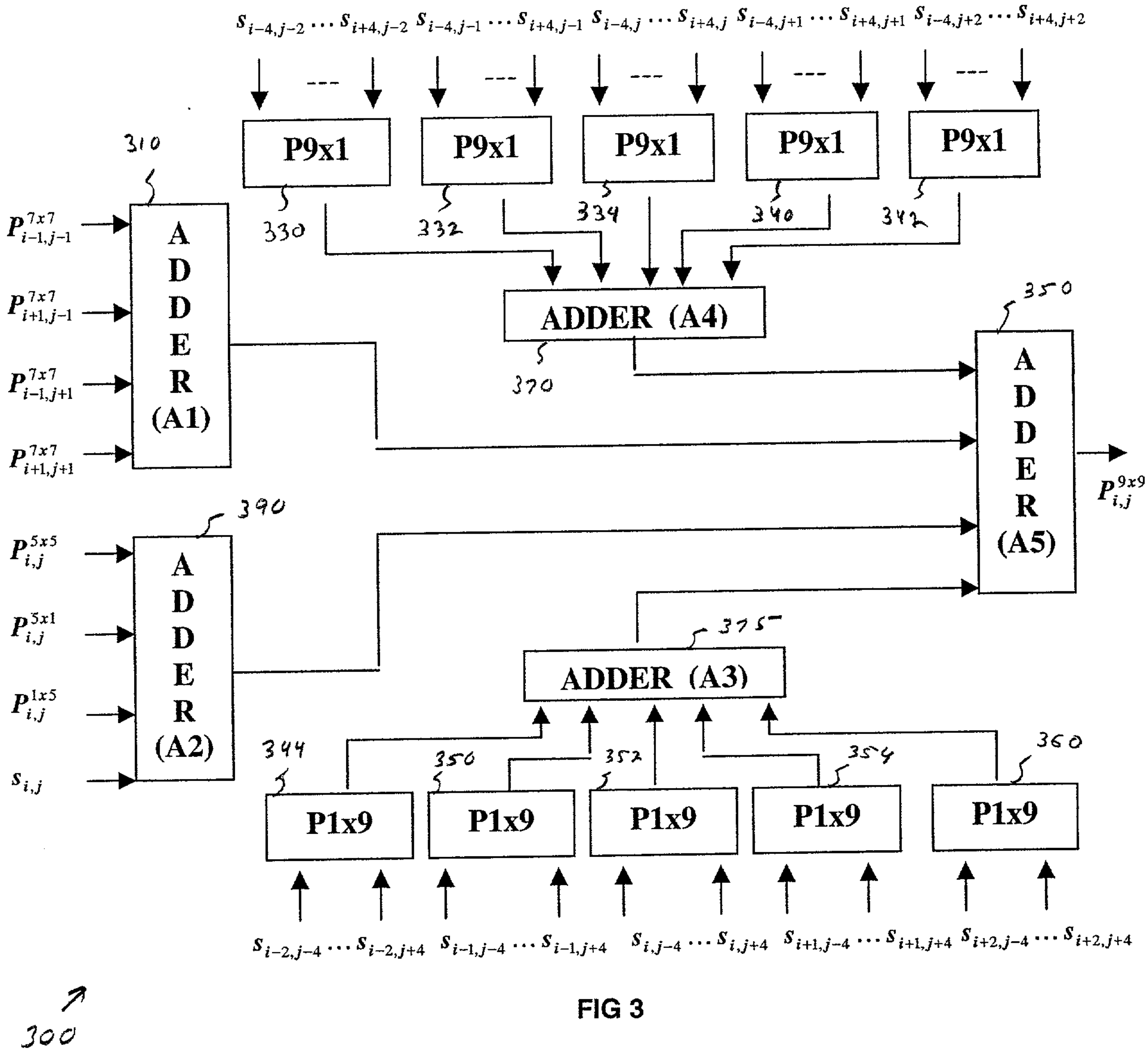
Image
FIR_3x3
FIR_5x5
FIR_7x7
FIR_9x9
FIR_NxN
Blur_
Blur_
Blur_
Blur_
Blur_

FIG. 1



B_3
B_5
B_7
X
ADD9
D1
ADD10
D2
ADD11
S_3
S_5
S_7
D
ADD
ADD
ADD
ADD
ADD
ADD
S_1
D
S_2
S_4
S_6
X

FIG. 2



$s_{i-4,j-2} \cdots s_{i+4,j-2}$ $s_{i-4,j-1} \cdots s_{i+4,j-1}$ $s_{i-4,j} \cdots s_{i+4,j}$ $s_{i-4,j+1} \cdots s_{i+4,j+1}$ $s_{i-4,j+2} \cdots s_{i+4,j+2}$
P9x1
P9x1
P9x1
P9x1
P9x1
310
330
332
334
340
342
$P^{7x7}_{i-1,j-1}$
$P^{7x7}_{i+1,j-1}$
$P^{7x7}_{i-1,j+1}$
$P^{7x7}_{i+1,j+1}$
ADDER (A1)
ADDER (A4)
370
350
ADDER (A5)
$P^{9x9}_{i,j}$
390
$P^{5x5}_{i,j}$
$P^{5x1}_{i,j}$
$P^{1x5}_{i,j}$
$s_{i,j}$
ADDER (A2)
375
ADDER (A3)
344
356
352
354
360
P1x9
P1x9
P1x9
P1x9
P1x9
$s_{i-2,j-4} \cdots s_{i-2,j+4}$ $s_{i-1,j-4} \cdots s_{i-1,j+4}$ $s_{i,j-4} \cdots s_{i,j+4}$ $s_{i+1,j-4} \cdots s_{i+1,j+4}$ $s_{i+2,j-4} \cdots s_{i+2,j+4}$
300

FIG 3

FIG. 4

$$P^{kxk} = \begin{bmatrix} P_{0,0}^{kxk} & P_{0,1}^{kxk} & . & \cdots & . & . & P_{0,N-1}^{kxk} \\ P_{1,0}^{kxk} & P_{1,1}^{kxk} & . & . & . & . & P_{1,N-1}^{kxk} \\ . & . & . & . & . & . & . \\ \vdots & . & . & P_{i,j}^{kxk} & . & . & \vdots \\ . & . & . & . & . & . & . \\ . & . & . & . & . & . & . \\ P_{M-1,0}^{kxk} & P_{M-1,1}^{kxk} & . & \cdots & . & . & P_{M-1,N-1}^{kxk} \end{bmatrix}$$

FIG. 5

$$S = \begin{bmatrix} s_{0,0} & s_{0,1} & \cdot & \cdots & \cdot & \cdot & s_{0,N-1} \\ s_{1,0} & \cdot & \cdot & \cdot & \cdot & \cdot & s_{1,N-1} \\ \cdot & \cdot & s_{i-1,j-1} & s_{i-1,j} & s_{i-1,j+1} & \cdot & \cdot \\ \vdots & \cdot & s_{i,j-1} & s_{i,j} & s_{i,j+1} & \cdot & \vdots \\ \cdot & \cdot & s_{i+1,j-1} & s_{i+1,j} & s_{i+1,j+1} & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ s_{M-1,0} & s_{M-1,1} & \cdot & \cdots & & \cdot & s_{M-1,N-1} \end{bmatrix}$$

$$
F_{kxk} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ \vdots \\ \frac{k-1}{2} \\ \vdots \\ 3 \\ 2 \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 2 & 3 & \cdots & \frac{k-1}{2} & 4 & 3 & 2 & 1 \end{bmatrix}
$$

$$
= \begin{bmatrix}
1 & 2 & 3 & \cdots & \frac{k-1}{2} & \cdots & 3 & 2 & 1 \\
2 & 4 & 6 & \cdots & \frac{2(k-1)}{2} & \cdots & 6 & 4 & 2 \\
3 & 6 & 9 & \cdots & \frac{3(k-1)}{2} & \cdots & 9 & 6 & 3 \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
\frac{k-1}{2} & \frac{2(k-1)}{2} & \frac{3(k-1)}{2} & \cdots & \frac{(k-1)*(k-1)}{4} & \cdots & \frac{3(k-1)}{2} & \frac{2(k-1)}{2} & \frac{k-1}{2} \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
3 & 6 & 9 & \cdots & \frac{3(k-1)}{2} & \cdots & 9 & 6 & 3 \\
2 & 4 & 6 & \cdots & \frac{2(k-1)}{2} & \cdots & 6 & 4 & 2 \\
1 & 2 & 3 & \cdots & \frac{k-1}{2} & \cdots & 3 & 2 & 1
\end{bmatrix}
$$

FIG. 6

$$F_{9x9}=\begin{bmatrix}1\\2\\3\\4\\5\\4\\3\\2\\1\end{bmatrix}*\begin{bmatrix}1 & 2 & 3 & 4 & 5 & 4 & 3 & 2 & 1\end{bmatrix}=\begin{bmatrix}1 & 2 & 3 & 4 & 5 & 4 & 3 & 2 & 1\\2 & 4 & 6 & 8 & 10 & 8 & 6 & 4 & 2\\3 & 6 & 9 & 12 & 15 & 12 & 9 & 6 & 3\\4 & 8 & 12 & 16 & 20 & 16 & 12 & 8 & 4\\5 & 10 & 15 & 20 & 25 & 20 & 15 & 10 & 5\\4 & 8 & 12 & 16 & 20 & 16 & 12 & 8 & 4\\3 & 6 & 9 & 12 & 15 & 12 & 9 & 6 & 3\\2 & 4 & 6 & 8 & 10 & 8 & 6 & 4 & 2\\1 & 2 & 3 & 4 & 5 & 4 & 3 & 2 & 1\end{bmatrix}$$

FIG. 7

$$
\boldsymbol{P}^{1xk} = \begin{bmatrix}
\boldsymbol{P}_{0,0}^{1xk} & \boldsymbol{P}_{0,1}^{1xk} & . & \cdots & . \; . & \boldsymbol{P}_{0,N-1}^{1xk} \\
\boldsymbol{P}_{1,0}^{1xk} & \boldsymbol{P}_{1,1}^{1xk} & . & . & . \; . & \boldsymbol{P}_{1,N-1}^{1xk} \\
. & . & . & . & . \; . & . \\
\vdots & . & . & \boldsymbol{P}_{i,j}^{1xk} & . \; . & \vdots \\
. & . & . & . & . \; . & . \\
. & . & . & . & . \; . & . \\
\boldsymbol{P}_{M-1,0}^{1xk} & \boldsymbol{P}_{M-1,1}^{1xk} & . & \cdots & . \; . & \boldsymbol{P}_{M-1,N-1}^{1xk}
\end{bmatrix}
$$

FIG. 8

$$
\boldsymbol{P}^{kx1} = \begin{bmatrix}
\boldsymbol{P}_{0,0}^{kx1} & \boldsymbol{P}_{0,1}^{kx1} & . & \cdots & . \; . & \boldsymbol{P}_{0,N-1}^{kx1} \\
\boldsymbol{P}_{1,0}^{kx1} & \boldsymbol{P}_{1,1}^{kx1} & . & . & . \; . & \boldsymbol{P}_{1,N-1}^{kx1} \\
. & . & . & . & . \; . & . \\
\vdots & . & . & \boldsymbol{P}_{i,j}^{kx1} & . \; . & \vdots \\
. & . & . & . & . \; . & . \\
. & . & . & . & . \; . & . \\
\boldsymbol{P}_{M-1,0}^{kx1} & \boldsymbol{P}_{M-1,1}^{kx1} & . & \cdots & . \; . & \boldsymbol{P}_{M-1,N-1}^{kx1}
\end{bmatrix}
$$

FIG. 9